REMARKS

Claims 13-19, 60-63, 65, 67-72, 74-76, 78-90, and 92-96 are pending in the present application. Claims 12-19, 59-63, 65-72, and 74-92 have been rejected under § 112 as failing to comply with the enablement requirement.

Claim 93 has been amended (by replacing "temperatures" with "temperature") to correct an inadvertent error. The amendments to claim 93 were not made in response to any rejection.

Claim 95 has been amended (by deleting "the step of") to correct an inadvertent error. The amendment to claim 95 were not made in response to any rejection.

Telephone Interview

On July 11, 2008, a telephone interview was conducted with Examiner Langel, Bruce Johnson, Jacob Phillips, and inventors Don McCollor and Steven Benson. The participants discussed the claims and the § 112 rejection. Applicants provided reasoning why one of ordinary skill in the art would understand how to program and configure CHEMKIN and FLUENT to perform the claimed functions. Examiner Langel suggested that a Rule 132 Declaration to that effect be submitted.

Brief Description with Passages in the Specification Cited

To help make the following arguments clear, a brief description of the apparatus and method described in the specification follows. Citations to the Specification and Drawings are included.

The description relates to the field of combustion systems, including techniques for capturing gas phase pollutants, such as sulfur trioxide (SO_3). (Spec., p. 2, para. 2). A typical

combustion system includes a furnace or combustion chamber for burning fuel and an air preheater for heating an air stream before being injected into the furnace. (Spec., p.p. 2-3, para. 3). Combustion systems burn the fuel and extract energy, resulting in gas cooling. System design and operating conditions impact the form and fate of fuel impurities. Fuel impurities include S, N, Hg, Na, Al, Si, P, K, Ca, Ti, Fe, V, Ni, As, Cl, and others. The description provides methods and systems for improving the capture of impurities (pollutants).

Computational fluid dynamics (CFD) computer code, such as FLUENT (described below), facilitates the calculation of gas velocity and temperature. Gas composition can be calculated based on fuel composition. (See, for example, p. 13, para. 27; FIG. 3). Chemical reaction kinetic computer code, such as CHEMKIN (described below), facilitates the calculation of rates of reaction, rates of pollutant formation (e.g., SO_3), etc. (See, for example, p. 12, para. 26; FIG. 3). Note that none of these programs (alone or in combination) teaches or suggests how to determine factors such as optimal injection locations, optimal particle sizes, optimal particle amounts. In addition, note that these programs teach nothing (to Applicant's knowledge) about injecting particles into a combustion system to capture gas phase pollutants.

Condensation (homogeneous and heterogeneous) of gas phase species can be calculated as a function of gas temperature. (See, for example, p.p. 15-16, para. 33; FIGS. 2, 5). The injection of fine sorbents provides sites for heterogeneous condensation of pollutants. (See, for example, p. 9, para. 20). Optimal injection rates and locations and other operating conditions can be determined, based on the calculations above. (See, for example, p. 16, para. 35; p.p. 18-19, para. 39). The operation of the system can be modified to increase condensation of gas phase species, such as SO_3. (See, for example, p. 9, para. 20). Note that this is typically not an acceptable operating regimine, due to air preheater fouling. This fact emphasizes the benefit of

using the calcuations described above to achieve these non-typical operating conditions. The increased heterogeneous condensation described above can be accomplished by use of the calculations above to predict the particle size and composition distribution (PSCD) of ash produced during combustion and the condensation of the volatilized species on the surfaces of sorbent at various injection rates and ash particles. (See, for example, p.p. 11-12, para. 24; p. 14, para. 30; p.p. 15-16, para. 33; FIG. 5). The end result is lower emisions of SO_3 and other gas phase pollutants. The description provides specific examples of the application of these processes. (See, for example, p.p. 16-18, para. 36-38; Table 1; FIGS. 6,7). As illustrated by these examples, measured SO_3 levels indicated good agreement with the predicted levels.

<u>§ 112 Rejection</u>

The Office Action alleges that the claims contain subject matter which was not described in the specification in such a way as to enable one skilled in the art to make and/or use the invention. The Office Action states that applicants' previous arguments are not convincing, and provides two reasons. First, the Office Action states that applicants' have not explained why it would not require undue experimentation for one of ordinary skill in the art to determine how the various computer programs are interconnected to simultaneously model such parameters as flow patterns, temperature patterns, and condensation reactions. Second, the Office Action states that applicants have not explained where the specification provides enablement for properly programming the CHEMKIN and FLUENT computer models to perform the disclosed and claimed functions.

With respect to the first argument (that applicants have not explained why it would not require undue experimentation for one of ordinary skill in the art to determine how the various

computer programs are interconnected to simultaneously model such parameters as flow patterns, temperature patterns, and condensation reactions), applicants are assuming that this argument applies only to independent claim 93 (and its dependent claims), since the other claims do not recite modeling any parameters. Also, applicants note that independent claim 93 does not require that any computer programs be interconnected with one another, or that they simultaneously model parameters. Claim 93 is discussed in detail below.

With respect to the second argument (that applicants have not explained where the specification provides enablement for properly programming the CHEMKIN and FLUENT computer models to perform the disclosed and claimed functions), applicants disagree, and have provided evidence in the accompanying § 132 Declaration and its attachments.

As discussed in the § 132 Declaration, CHEMKIN and FLUENT are off-the-shelf products, and one skilled in the art would understand how to properly configure and program them. (McCollor Declaration, para. 3, 4).

CHEMKIN is a software tool for solving complex chemical kinetics problems. CHEMKIN is a set of flexible tools for incorporating complex chemical kinetics into simulations of reacting flow. Using CHEMKIN, users are able to investigate thousands of reaction combinations to develop a comprehensive understanding of a particular process, which might involve multiple chemical species, concentration ranges, and gas temperatures. One skilled in the art understands what CHEMKIN can do, as well as how to properly configure and program CHEMKIN to perform various functions. Further, the maker of CHEMKIN provides detailed instructions and manuals relating to the use of CHEMKIN. (McCollor Declaration, para. 3).

FLUENT is computational fluid dynamics (CFD) flow modeling software. FLUENT can be used to calculate gas velocity and temperature in a combustion system. One skilled in the art

understands what FLUENT can do, as well as how to properly configure and program FLUENT to perform various functions. Further, the maker of FLUENT provides detailed instructions and manuals relating to the use of FLUENT. (McCollor Declaration, para. 4).

Independent Claim 93

Claim 93 recites "modeling flow patterns," "modeling temperature patterns," and "modeling condensation reactions" of a combustion system. Claim 93 does not require how these parameters are modeled, when they are modeled (with respect to each other), or how any modeling programs might be interconnected. The Specification provides examples of modeling of various parameters in a combustion system. While any desired type of computer models may be used with the present invention, the Specification describes examples. Other computer models may also be used within the spirit and scope of the invention. In the previous Office Action, the Office admits that the specification discloses how various programs can be used to model various parameters. (10/26/07 Office Action, p. 3, lines 2-3).

Claim 93 also recites "using the modeled flow patterns, modeled temperature patterns, and modeled condensation reactions to predict the impact on gas phase pollutants from injecting particles into the combustion system, and to predict the impact on gas phase pollutants by the particle size distribution and the amount of injected particles in order to reduce the pollutants to a desired level," "using the modeled flow patterns, modeled temperature patterns, and modeled condensation reactions to determine one or more optimal locations in the combustion system for the injection of particles," "using the modeled flow patterns, modeled temperature patterns, and modeled condensation reactions to determine an optimal size and amount of particles to be injected," and "injecting the determined amount and size of particles into the combustion system

at one or more of the determined locations to capture gas phase pollutants in the combustion system."

The Specification also describes how modeling these various parameters can be used to predict various aspects of the operation of a combustion system. (For example, see Spec., p. 10-11, para. 22, 24, as well as the discussion above). The modeled parameters can be used to determine optimal locations in a combustion system for the injection of particles. For example, the Specification describes one example of a desired injection location as a location where the particles will capture the pollutants in the most efficient manner, for example, at locations where the temperature patterns are such that pollutant condensation starts to occur. (For example, see Spec., p. 8, para. 19). These determinations are accomplished using the modeled parameters. In another example, the Specification describes determining particle injection locations using a temperature profile generated from a model to reveal locations where pollutant condensation starts to occur, then recites that an optimal location can be a location such that pollution condensation occurs primarily on the injected particles. (For example, see Spec., p. 18-19, para. 39). In another example, the Specification describes determining optimum particle concentration, size, and amount, using modeled parameters to determine when pollutant concentration is reduced to an acceptable level. The Specification also recites that, with or without using a model, pollutant removal can be measured experimentally using various locations and/or various particle concentrations, sizes, and amounts. When the pollutant level is measured to be an acceptable level, the corresponding injection location and particle concentration, size and amount can be used. (For example, see Spec., p. 18-19, para. 39).

As illustrated above, each of the elements of claim 93 is described in the Specification sufficiently that one skilled in the art could make and/or use the invention.

Independent Claim 94

Independent claim 94 recites a method of capturing gas phase pollutants in a combustion system downstream of a combustion zone comprising "predicting the temperature gradient and location in the combustion system where the critical phenomena of condensation of gas phase pollutants occur," and "using the predicted temperature gradient and location to predict the effect of modifications to the combustion system, wherein the size distribution of resultant ash particles in the combustion system has an increased population of fine particles below 5 microns compared to the combustion system without the modifications." Applicant asserts that new independent claim 94 complies with the enablement requirement.

The Specification discusses how modifications to a combustion system can help the capture of gas phase pollutants. (For example, see Spec., p.p. 8-9, para. 20). The Specification also discusses determining the behavior of various parameters in a combustion system under different conditions. In one example, the temperature gradient and location in a combustion system where the critical phenomena of condensation of gas phase pollutants occurs can be determined. (For example, see Spec., p.p. 18-19, para. 39). Once temperature patterns and their relative locations are determined, the effect of modifications to the combustion system can be predicted (e.g., modification which increase condensation, etc.). The Specification also teaches that there is a significant capture of pollutants (e.g., SO_3) in the presence of fine particles less than approximately 5 μm in diameter as the SO_3-containing flue gases pass through an air preheater. (For example, see Spec., p. 10, para. 21, p. 18, para. 38).

Independent Claim 95

Independent claim 95 recites a method of capturing gas phase pollutants in a combustion system including "predicting the temperature gradient and location in the combustion system where the critical phenomena of condensation of gas phase pollutants occur," "using the predicted temperature gradient and location to configure the combustion system, including determining optimal distribution of particles and particle injection locations in the combustion system to enhance the heterogeneous condensation of gas phase pollutants onto the injected particles," and "injecting particles into the combustion system at one or more locations, wherein the size of the particles and the location of the injection are chosen such that pollutant condensation occurs primarily on the injected particles." Applicant asserts that new independent claim 95 complies with the enablement requirement.

As mentioned above, the Specification discusses determining the behavior of various parameters in a combustion system under different conditions. In one example, the temperature gradient and location in a combustion system where the critical phenomena of condensation of gas phase pollutants occurs can be determined. (For example, see Spec., p.p. 18-19, para. 39). Once temperature patterns and their relative locations are determined, the effect of the configuration of the combustion system can be determined, including the distribution and injection locations of particles. Once this is known, optimal distribution and injection locations of particles can be determined.

Independent Claim 96

Independent claim 96 recites a method of capturing gas phase pollutants in a combustion system downstream of a combustion zone, including "predicting the temperature gradient and

location in the combustion system where the critical phenomena of condensation of the gas phase pollutants occur," "using the predicted temperature gradient and location to determine optimal size distribution of particles and locations to inject particles into the combustion system to enhance heterogeneous condensation of gas phase pollutants onto the injected particles," and "injecting particles into the combustion system at one or more of the determined locations." Applicant asserts that new independent claim 96 complies with the enablement requirement.

As mentioned above, the Specification discusses determining the behavior of various parameters in a combustion system under different conditions. In one example, the temperature gradient and location in a combustion system where the critical phenomena of condensation of gas phase pollutants occurs can be determined. (For example, see Spec., p.p. 18-19, para. 39). Once temperature patterns and their relative locations are determined, optimal distribution and injection locations of particles can be determined.

It is respectfully submitted that all claims are patentable over the prior art. It is further more respectfully submitted that all other matters have been addressed and remedied and that the application is in form for allowance. Should there remain unresolved issues that require adverse action, it is respectfully requested that the Examiner telephone Bruce A. Johnson, Applicants' Attorney, at 512-301-9900 so that such issues may be resolved as expeditiously as possible. Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 to deposit

account number 50-3864 (Johnson & Associates).

Respectfully Submitted,

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Date

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